

Economics of Recovery

An estimate of the cost of implementing the Recovery Strategy is required by California statute. In cooperation with the CRT and the SSRT, quantitative estimates were developed for both the fiscal cost of implementing the Recovery Strategy, and the socioeconomic impacts of implementing the Recovery Strategy. Summary information is provided below. For a more in-depth discussion, refer to the complete economic report in Appendix I.

The assumption in the economic analysis is that Governments will bear the cost of “positive” incentives needed to acquire water, conservation easements and other assets, and will also bear the cost of public works projects, dam removal, and timber management Alternative C, which was selected for inclusion by the Commission. Private landowners will bear the cost of coming into compliance with existing laws and the cost of additional regulations that pertain to listing of the species.

11.1 ECONOMIC BENEFITS

Coho salmon recovery will have significant costs, but will also provide economic benefits. Benefits associated with Yurok and Hoopa Valley tribes’ Federally reserved fishing rights, increased commercial land and water use activities, multiple species benefits, and improved water quality, and watershed health will be realized, but they are not quantified. Coho salmon recovery will also result in benefits to recreational and commercial fishing and related industries, which are also not quantified in this document.

Benefits associated with non-use values include intrinsic, or existence, values which are derived from the knowledge that coho salmon populations exist, and bequest values which confer value to the resource for the benefit of future generations. Based on studies that examined streams in Colorado and salmon restoration in the Columbia River Basin, the San Joaquin River, and the Elwha River, the extrapolated value of California coho salmon recovery could be significantly larger than the fiscal or socioeconomic costs of recovery.

11.2 FISCAL COSTS AND SOCIOECONOMIC IMPACTS

The economics analysis (Appendix I) considers the costs of a variety of recovery recommendations implemented in diverse regions of California. The fiscal or budgetary cost of a recovery recommendation is the expenditure needed to physically perform the action. The socioeconomic impact of a recovery recommendation includes: 1) income foregone because the recovery recommendation is undertaken, and 2) transfers to the local region (in this case, the HSA) from outside the region because the recovery recommendation is undertaken.

Fiscal cost impacts of the various recovery recommendations are presented in the simplest possible terms: the current dollar cost of completing the project now. Absent information about the specific sequencing of recovery recommendations over the coming decades, and lacking information on how State obligations would be financed, it is impossible to calculate financing costs,

or convert actions over some period of time into current dollar equivalents. Instead, the costs were simply calculated as if all recovery recommendations would be completed immediately.

In order to develop these cost and impact assessments, the primary unit of analysis is the HSA. There are three classes of recovery costs at the HSA level. The first class of costs is the cost of commonly recommended recovery recommendations that are proposed for many HSAs. The second category is those costs unique to the specific circumstances of an HSA or HU. The third category is costs that have been identified but which cannot be quantified at this time. Each of these classes of costs has associated socioeconomic impacts.

The total fiscal cost of the Recovery Strategy is about \$4.5 billion. This cost estimate may understate the full cost of Recovery Strategy implementation, because some costs cannot be quantified at this time. There is limited information available about the quantity of each recovery action that will be undertaken and these cost estimates can be revised as additional information becomes available. On the other hand, this cost estimate may overestimate the cost of Recovery Strategy implementation because some costs may be incurred even if the Recovery Strategy were not implemented. In addition, some costs may be incurred as a result of actions taken to avoid take of coho salmon or to fully mitigate impacts of authorized take once the species is listed. The following cost estimates must be viewed with these considerations in mind.

Using the current level of information on the recommendations contained in this strategy, about \$466 million, or 9% of the total, will be incurred to implement the SSPP. However, it should be noted that the actual fraction of costs incurred in Shasta Valley and Scott River HSAs will be less than this because the cost of water acquisition has been included for the SSPP, but has not been measured for the rest of the coho salmon range. The SSPP recommendations also are intended to be more focused than those in other watersheds. Nonetheless, a notably large portion of costs will be incurred in these HSAs. If water acquisition costs in other areas of the SONCC Coho ESU and in the CCC Coho ESU are proportional to those in the SSPP (where water acquisition accounts for about 20% of the total) it is likely that the costs of recovery under the strategy will approach \$5 billion.

Restoration costs are higher in the SONCC Coho ESU than the CCC Coho ESU, likely because coho salmon are more widely distributed within the SONCC Coho ESU. Costs are especially high in the Klamath River HU, where Iron Gate Dam is located. High costs were also noted in the Mendocino Coast and Trinity River HUs. These three HUs, combined, account for over 85% of measured restoration costs.

Monitoring, evaluation, planning, and education and outreach costs are about \$90 million dollars; about 2% of total estimate fiscal costs. There are no significant socioeconomic impacts associated with these recommendations.

Restoration activities will generate positive socioeconomic impacts. Socioeconomic impacts generated from restoration equal about one-half of the fiscal costs of restoration or \$2.1 billion. The socioeconomic impacts of water acquisition in the SONCC range will be negative (for the SSPP these negative impacts equal about \$6 million), as will the socioeconomic impacts of timber management changes. Negative socioeconomic impacts of the timber management changes are not expected to be significant. Implementing the timber management recommendations will result in few incremental costs.

11.2.1 UNIT COSTS

In the first step of measuring the economic cost and impact of implementing the Recovery Strategy, recovery recommendations common to many HSAs are identified. Unit costs for these activities were estimated, and ways in which costs vary systematically across HSAs were identified. Unit cost estimates were developed for the following commonly recommended recovery recommendations:

- a. Removing or alleviating barriers to fish passage;
- b. Implementing riparian revegetation and other stream-bank improvements;
- c. Improving in-stream complexity, including the placement of LWD;
- d. Road treatment and/or decommissioning;
- e. Restoring wetlands and off-channel areas;
- f. Water acquisitions;
- g. Undertaking biological studies to understand and monitor coho salmon behavior;
- h. Watershed planning and other non-biological studies;
- i. Education and outreach efforts (including improvements in coordination among participants); and
- j. Timber management.

Aggregate cost estimates for these common recovery recommendations were developed with a series of restoration cost models. These models are designed to combine unit cost estimates with information on the potential scale at which recommended activities could be undertaken and information about the ways that unit costs are likely to vary across HU/HSAs.¹ At this time, limited information is available about the quantity of each recovery recommendation that will be undertaken. Maximum flexibility was built into these spreadsheet models so that, as additional information about the scale at which recovery recommendations will be undertaken becomes available, more accurate estimates of the aggregate cost of recovery can be made easily and quickly.

In some cases the recommendations in the Recovery Strategy do not provide guidance on the scale at which recommended activities should be undertaken. For example, at the HU- and HSA-level the recommendations do not specify the amount of water acquisition that may be required to meet recovery goals. This omission precludes the comprehensive measurement of the cost of coho salmon recovery. Nonetheless, cost and socioeconomic impact estimates for many recovery recommendations can be developed, and unit costs can be characterized in even more cases.

11.2.1.1 Fish Passage

The cost of treating barriers to fish passage includes a discussion of the unit cost of dam removal, installing fish ladders, treating non-structural sites, replacing culverts, and screening water diversions. To estimate the fiscal cost of treating barriers to fish passage, surveys of the cost of fish passage improvement in general and indicative project costs in California and to a lesser extent Oregon and Washington, were used. The review of historical barrier treatment projects allows an estimate of the fraction of project costs that are attributable to permitting, planning, and mobilization. The socioeconomic impact was calculated in the form of regional transfers that will occur as a result of barrier treatment to be total fiscal costs less that fraction.

¹ A major source of variation is likely to come from regional differences in wage rates since labor costs form a large part of the total unit cost of most recovery recommendations. Data on average wages paid to construction workers in California counties were used to identify how recovery costs are likely to vary across HSAs as a result of labor costs. For HSAs that fall in more than one county, wages are assumed to be a simple average of the wages in all counties covered

11.2.1.2 Riparian Restoration

The fiscal costs of riparian revegetation or planting and other stream-bank improvement activities, including fencing, depend on the complexity of the project to be undertaken (e.g., the materials to be used), the remoteness of the parcel of land to be treated, and the degree of site preparation that is needed. While the quantity of stream bank that may need treatment and/or riparian planting was estimated, no information is currently available about the nature of sites that will be treated. The unit costs of stream-side activities were estimated using average construction cost estimates developed by the United States Department of Agriculture (USDA) and surveys of historical project costs. The assumption was used that at any stream mile that needs riparian revegetation, the width of the buffer created will be 50 feet. A review of historical projects allows one to estimate the fraction of project costs that are attributable to permitting, planning, and mobilization. The socioeconomic impact was calculated in the form of regional transfers that will occur as a result of riparian revegetation and stream-bank restoration to be total fiscal costs less that fraction. There will be other welfare costs associated with removing land from its highest and best private use and dedicating this land to habitat for salmon. These costs cannot be quantified at this time.

11.2.1.3 In-channel Restoration

The costs of in-channel restoration work, including the placement of LWD, depend on the remoteness of the site to be treated and the width of the waterway to be treated. No information was available about these parameters for the in-stream sites that will be treated as a result of the Recovery Strategy. Illustrative unit costs for these activities were developed by surveying historical project costs and previous literature on this topic. The review of historical projects allows one to estimate the fraction of project costs that are attributable to permitting, planning, and mobilization. The socioeconomic impact was calculated in the form of regional transfers that will occur as a result of in-stream restoration to be total fiscal costs less that fraction.

11.2.1.4 Road Treatment and Decommissioning

The Recovery Strategy contains several broad categories of recommendations dealing with roads, which differ in their unit cost, socioeconomic impacts and, likely, in their cost-effectiveness. The broad categories of recommendations are:

- a. Road decommissioning;
- b. Road upgrading;
- c. Relocation of roads in riparian areas;
- d. Implementation of best-management practices (BMPs) in road construction;
and
- e. Limiting use of roads (e.g., in winter or if road is legally closed).

The average unit cost and socioeconomic impact of road decommissioning and upgrading was estimated based on surveys of historical project costs. However, no information is available about which roads will actually be treated, relocated, or have access limited. This precludes a full accounting of impacts of this class of recovery recommendation.

11.2.1.5 Wetlands Restoration

In a limited number of HUs/HSAs wetlands restoration is mentioned as a recovery recommendation. Many of the activities that fall under the category of wetlands restoration, as defined by the USDA, are also common to the other categories of restoration activities considered. For example, the USDA considers culvert replacement, fencing, and critical area planting

to be activities that may be undertaken as part of wetlands restoration. Since the quantities of these activities that will be undertaken in any given HSA are not known, the aggregate cost of wetlands restoration is not calculated distinct from other, related, recovery recommendations. The socioeconomic impacts of wetland restoration will depend on the alternative use of the land devoted to coho salmon as a result of the restoration effort but these costs cannot be quantified at this time.

11.2.1.6 Water Acquisition

The aggregate fiscal cost of water acquisition and/or agricultural land acquisition within the range of coho salmon will depend on the quantity of water and/or land to be acquired and whether water rights will be permanently transferred or purchased for single periods. Because potential sellers of water rights may decide to forgo the agricultural profits they would have gained from irrigating (instead of making alternative arrangements for other sources of water), we can predict that in those circumstances the annual cost of an acre-foot of water in a particular HSA is predicted to be equal to the net agricultural returns (gross returns less operating costs) that water would have created. The unit cost of water acquisition increases sharply when acquisition of irrigation water for pasture is complete and water that is used to irrigate increasingly high value cropland (e.g., wine grapes, broccoli) is acquired.

Taking agricultural land out of production so that more water is available for coho salmon recovery has a socioeconomic cost because land that once provided private income no longer does so. Conceptually, when agricultural land is left fallow because irrigation water has been transferred to serving the needs of coho salmon, the farmer that sold the water right has neither lost nor gained income. However, the laborers that worked this land and the firms that sold the farmer inputs for this land have not been made whole. Their lost income, equal to the farmer's operating costs in the event that the parcel of land had been planted and harvested, is the socioeconomic cost of this recovery recommendation.

Aggregate water acquisition costs are estimated only for the SSPP. The SSPP contains several recovery recommendations intended to increased instream flows for coho salmon. These include, but are not limited to, verifying compliance with adjudicated water rights, donation of unused water rights, providing alternative stock water systems, substitution of groundwater for surface water for irrigation, and water acquisition. It cannot be known with certainty how much water will be produced for coho salmon through each of these strategies. To obtain an estimate of the full costs of securing instream flows for coho salmon, this analysis assumes that additional instream flows will be generated solely through the acquisition of water rights from willing sellers. This assumption is made only for the purposes of an illustrative calculation of the cost of recovery and should not be taken as an endorsement of this approach to increasing instream flows in the SSPP area or elsewhere.

11.2.1.7 Monitoring and Research

Technical studies that the Recovery Strategy recommends range from monitoring efforts to genetic analyses. A review of the Department's inventory of previously funded restoration activities allows us to estimate the cost of recovery recommendations that are technical monitoring or biological research activities when project-specific cost estimates are not readily available. A similar approach is used to estimate the cost of non-biological studies or planning exercises and education and outreach efforts. The assumption is that these costs do not vary systematically by HSA. The socioeconomic impacts of this class of recovery recommendations are not expected to be significant.

11.2.2 COST ESTIMATES

The aggregate cost estimates presented in Appendix I include not only the cost of performing recommendations that are common to many HU/HSAs, but also the cost of specific tasks that respond to the unique circumstances of each HU/HSA. Some of these items are a significant portion of the costs estimated here. For example, restoring coarse sediment transport near Iron Gate Dam may cost as much as \$500 million. Implementing the Trinity Record of Decision is estimated to cost about \$12 million per year.

Separate cost and socioeconomic impact estimates have been developed for the Shasta Valley and Scott River HSAs. The methodology used to estimate the cost of implementing the SSPP is similar to the methodology used to estimate the cost of the general Recovery Strategy. For habitat restoration in particular, the methodology described above is directly applied. However, by working closely with the SSRT cost estimates are provided for nearly every suggested recovery recommendation.² These cost estimates are included in Appendix I. This approach reflects the fact that the SSPP contains many recovery recommendations related to water management and acquisition that are not found in the larger Recovery Strategy.

Three alternative sets of recommendations were developed regarding timber management in areas with coho salmon. Alternative C (and elements of Alternative B that have few costs associated with them) were adopted by the Commission. There are few incremental costs and socioeconomic impacts associated with Alternative C and elements 19 and 20 of Alternative B.

The adopted timber management recommendations do not imply significant incremental costs above those estimated in other sections of the economic report. The recommendations call for implementation of road management plans, which may imply that costs will be incurred to decommission or treat roads, treatment of watercourse crossings, riparian revegetation, watershed planning, education, and monitoring of recovery measures. The costs of these actions have been estimated in other sections of the economic report.

To illustrate which costs previously estimated are also associated with the adopted timber management recommendations, the following were identified: 1) HSAs with at least 75 percent of land cover in forest; 2) HUs containing these HSAs; and 3) costs of road treatment, road decommissioning, riparian revegetation, and treatment of stream crossings in those HUs. These estimated costs are summarized in Table 11-1. The total amount of costs associated with timber management recommendations, excluding planning, education, and monitoring, is about \$1.7 billion.

Some items included in the estimate of the aggregate cost of the Recovery Strategy are costs that may be incurred even if this Recovery Strategy were not implemented. For example, the cost of implementing the Trinity River Record of Decision is included as a cost associated with coho salmon recovery. To the extent that these costs would be incurred in the absence of this Recovery Strategy, the cost estimates presented here overstate the cost of implementation. In addition, some of these costs may be incurred not as a result of implementing the Recovery Strategy, but as a result of listing to the extent that costs are incurred as a result of actions taken to avoid take or to fully mitigate impacts of the authorized take of coho salmon. On the other hand, costs that would be incurred as a result of the Clean Water Act or other related statutes and regulations were excluded. While TMDL regulations, for example, are quite relevant to coho salmon recovery, costs attributable to this process are not counted as a cost of coho salmon recovery as the regulations would have been enacted anyway. However, many recommendations that target a reduction in sedimentation, which are included in Recovery Strategy costs, will also aid compliance with established TMDLs.

² No cost estimates have been developed for P-6, P-7, WUE-6a, WUE-6b, and WUE-6c. At this time, these recommendations are too general to cost.

Tables 11-1 through 11-3 summarize the measured fiscal cost of the Recovery Strategy. Habitat restoration costs are presented by HU; other costs are presented on a range-wide basis. Tables 11-4 and 11-5 summarize the measured socioeconomic impacts of the Recovery Strategy. Habitat restoration impacts are presented by HU, while other costs are presented on a range-wide basis. These estimates include the cost of implementing the SSPP, which is shown separately.

Some identified costs are not calculated at this stage. For example, the aggregate cost estimates in Tables 11-1 through 11-5 do not include specific line items for the range-wide recommendations because the majority of these recommendations cannot be assigned an estimated cost at this time. In addition, the cost of many of the range-wide recommendations will be captured by estimating the cost of the HU/HSA-specific recommendations. Given the magnitude of the measured recovery costs, failure to measure the costs of the range-wide recommendations explicitly does not qualitatively impact the recovery cost calculations. Another important unmeasured cost is the cost of water acquisition outside of the Shasta Valley and Scott River HSAs. These costs are likely to be significant, as are the associated socioeconomic impacts.

Another important unresolved issue with the cost of coho salmon recovery under the strategy is the role of increased enforcement of permits and take restrictions. There is some amount of unpermitted water diversion from streams containing coho salmon, for example, and some diverters take more than their allowable quantity. With regard to other issues like fencing, ESA and CESA take prohibitions may require that ranchers construct fencing and stock watering facilities more than is currently the case. This analysis has not attempted to parse out the total quantity of actions for recovery as opposed to actions required by the listing of the coho salmon. The costs of recovery were calculated based on the increment of various actions relative to the status quo.

The cost of achieving interim recovery goals is likely to include the cost of most of the biological and non-biological studies and watershed plan preparation called for in the Recovery Strategy. These costs will likely be incurred before many restoration costs. Other interim costs will include the cost of implementing restoration recommendations in the highest priority watersheds.

TABLE 11-1: Recovery strategy costs by Hydrologic Unit

HYDROLOGIC UNIT	COST (\$)
Big Basin	253,907,283
Bodega	17,574,450
Cape Mendocino	146,915,528
Eel River	612,526,817
Eureka Plain	22,403,308
Klamath River	849,118,462
Mad River	26,176,223
Marin Coastal	57,802,142
Mendocino Coast	780,043,197
Redwood Creek	23,866,194
Rogue River	7,034,832
Russian River	265,193,565
San Francisco Bay	130,564,775
San Mateo	63,270,569
Smith River	21,864,544
Trinidad	21,864,544
Trinity River	564,392,468
Winchuck River	2,827,116
Total SONCC (w/o SSPP)	1,680,502,407
Total CCC	1,465,138,565
Total SONCC/CCC Restoration Costs	3,954,194,850
Total SSPP Restoration	371,583,569
Total Restoration Incl. SSPP	4,325,778,420

SOURCE: Authors' calculation. Habitat restoration includes removal of barriers to fish passage, riparian revegetation and stream-bank improvements, placement of LWD and improvements in instream complexity, and road treatment and decommissioning. SSPP is the Shasta-Scott Pilot Program.

TABLE 11-2: Range-wide costs

COST CATEGORY	COST (\$)
MONITORING, EVALUATION AND PLANNING	
Total excl. SSPP	44,000,000
Total SSPP	10,604,000
Total incl. SSPP	54,604,000
EDUCATION AND OUTREACH	
Total excl. SSPP	31,000,000
Total SSPP	8,832,520
Total incl. SSPP	39,832,520
WATER MANAGEMENT	
Total excl. SSPP	--
Total SSPP	10,334,024
WATER USE EFFICIENCY	
Total excl. SSPP	--
Total SSPP	3,200,000
WATER ACQUISITION	
Total excl. SSPP	UNKNOWN
Total SSPP	60,217,676
PROTECTION	
Total excl. SSPP	0
Total SSPP	1,244,789
TIMBER MANAGEMENT	
Alternative C and elements 19 and 20 of Alternative B	FEW INCREMENTAL COSTS

SOURCE: Authors' calculation. SSPP is the Shasta-Scott Pilot Program. No cost estimates are available for water acquisition in the CCC or SONCC excluding the SSPP.

TABLE 11-3: Total estimated costs of coho salmon recovery

Total SONCC/CCC costs excluding water (\$)	4,492,194,850
Total SSPP costs (\$)	466,016,578

SOURCE: Authors' calculation. SSPP is the Shasta-Scott Pilot Program. No cost estimates are available for water acquisition in the CCC or SONCC excluding the SSPP. Excludes costs identified but not quantified.

TABLE 11-4: Socioeconomic impacts of restoration

HYDROLOGIC UNIT	IMPACTS (\$)
Big Basin	157,582,359
Bodega	6,867,489
Cape Mendocino	87,121,241
Eel River	346,282,468
Eureka Plain	5,404,169
Klamath River	219,664,691
Mad River	15,304,285
Marin Coastal	36,888,250
Mendocino Coast	465,155,708
Redwood Creek	12,975,736
Rogue River	4,980,192
Russian River	169,652,499
San Francisco Bay HUs	82,073,590
San Mateo	42,081,530
Smith River	68,695,861
Trinidad	15,330,384
Trinity River	247,326,119
Winchuck River	1,917,551
Total SONCC (w/o SSPP)	1,082,338,237
Total CCC	902,965,885
TOTAL SONCC/CCC RESTORATION COSTS	1,985,304,122
TOTAL SSPP RESTORATION	159,296,346
TOTAL RESTORATION INCLUDING SSPP	2,144,600,468

SOURCE: Authors' calculation. Habitat restoration includes removal of barriers to fish passage, riparian revegetation and stream-bank improvements, placement of LWD and improvements in instream complexity, and road treatment and decommissioning. SSPP is the Shasta-Scott Pilot Program.

TABLE 11-5: Range-wide measured socioeconomic impacts

COST CATEGORY	IMPACT (\$)
MONITORING, EVALUATION AND PLANNING	
Total excl. SSPP	0
Total SSPP	0
Total incl. SSPP	0
EDUCATION AND OUTREACH	
Total excl. SSPP	0
Total SSPP	0
Total incl. SSPP	0
WATER MANAGEMENT	
Total excl. SSPP	--
Total SSPP	0
WATER USE EFFICIENCY	
Total excl. SSPP	--
Total SSPP	2,020,000
WATER ACQUISITION	
Total excl. SSPP	UNKNOWN
Total SSPP	(6,143,359)
PROTECTION	
Total excl. SSPP	0
Total SSPP	0
TIMBER MANAGEMENT	
Alternative C and elements 19 and 20 of Alternative B	FEW INCREMENTAL IMPACTS

SOURCE: Authors' calculation. SSPP is the Shasta-Scott Pilot Program. No socioeconomic estimates are available for water acquisition in the CCC or SONCC excluding the SSPP.

